

Giovanni News

From the Editor:

Well, technically yes, it is August now. Because of summer travel and the length of time it took to compile our half-year update of Giovanni publications, it took a little bit longer to get this newsletter published. However, I think you'll find the contents quite interesting, as you read the summaries of six research papers that used Giovanni. All of these papers appeared in the first six months of 2015.

In all, there were 92 papers during this period, showing once again that Giovanni is a valuable tool in the Earth scientist's toolbox.

I hope you'll enjoy this issue. If you have any comments, feel free to email me at james.g.acker@nasa.gov.

Jim Acker
The Giovanni News Editor

A Web service and Android application for the distribution of rainfall estimates and Earth observation data.

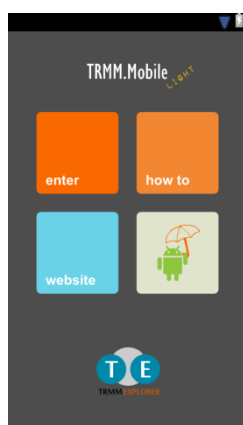
Mantas, V.M., Liu, Z., and Pereira, A.J.S.C. (2015) *Computers & Geosciences*, **77**, 66-76, doi:10.1016/j.cageo.2015.01.011.

The demand for simplified, rapid access to Earth science data is an ever-increasing concern for both scientists and science data archives. In this era of technological innovation, scientists and data users would prefer to receive Earth science data quickly, in a form that can be readily used, and preferably obtainable through a computing platform that is convenient and familiar.

The societal impact of smartphones means that some scientists would like to receive data (particularly real-time or near-real-time data) via such devices. The NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) pioneered simplified access to data and visualizations for precipitation data on the World Wide Web with the Tropical Rainfall Measuring Mission (TRMM) Online Visualization and Analysis System (TOVAS), a portal in the Giovanni system.

This paper describes an extension of TOVAS, called "TRMM Explorer", which has three primary goals, which are: "(1) simplify cross-platform access to Tropical Rainfall Measuring Mission Online Visualization and Analysis System (TOVAS) data (including from Android mobile devices), (2) provide customized and continuous monitoring of Satellite Rainfall Estimates (SRE) in response to user demands and (3) combine data from different online data distribution services, including rainfall estimates, river gauge measurements or imagery from Earth Observation missions at a single portal." Figures in the paper demonstrate the display of TRMM rainfall data simultaneously with streamflow data from gaging stations.

The paper describes the creation of TRMM Explorer, with a special emphasis on the development of the TRMM.Mobile Android app. A case history for rivers in southern Angola, the Southern Angola Watershed Collection (SAWC), is provided.



Entry page of the TRMM.Mobile App

Changes in the distribution of Al and particulate Fe along A16N in the eastern North Atlantic Ocean between 2003 and 2013: Implications for changes in dust deposition

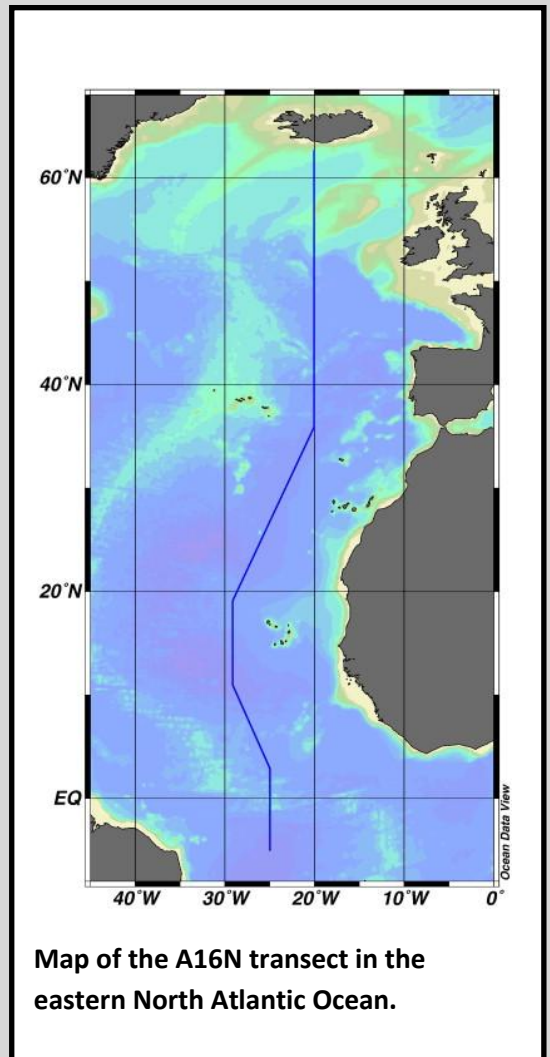
Barrett, P.M., Resing, J.A., Buck, N.J., Landing, W.M., Morton, P.L., and Shelley, R.U. (2015) *Marine Chemistry*, available online 21 February 2015, doi:10.1016/j.marchem.2015.02.009.

In 2003, as part of the *Climate and Ocean: Variability, Predictability, and Change* (CLIVAR) program, a research cruise was conducted along the “A16N” transect in the eastern North Atlantic Ocean. The transect started at the latitude of the Straits of Gibraltar and extended to a couple of degrees south of the Equator. Along this line, in an investigation of how much dust from the Sahara desert and adjacent semi-arid regions enters the ocean, researchers carefully measured the concentrations of particulate and dissolved aluminum (Al), a common metal in desert dust and sand, and particulate iron (Fe), also found in grains of sand and a vitally important oceanic micronutrient. (‘Particulate’ means associated with particles acquired on filters; ‘dissolved’ means as measured in the seawater itself.)

In 2013, researchers led by Pamela Barrett of the University of Washington repeated both the transect and the measurements made along the transect in 2003. This research provided a rare chance to compare differences in the concentrations of these atmospheric aerosol-derived metals and to determine if they have changed significantly over a decade.

Using precise measuring methods and protocols to eliminate contamination, the researchers measured the metal concentrations for seawater samples obtained at several stations along the transect, and at discrete depths at each station. They determined that while the distribution pattern of Al and Fe along the transect has remained similar between 2003 and 2013, particulate Al decreased at the surface and increased at depth, notably between 400-600 meters, and particulate Fe increased both at the surface and at depth, though much more markedly at depth. Dissolved Al increased at the surface and decreased at depth. The increases are attributed to increased dust deposition into the ocean surface waters.

Aerosol optical depth (AOD) data from Giovanni was then used to examine the AOD trends over this region of the ocean. In agreement with other sources, Giovanni demonstrated a *decrease* in AOD over this time period. The conclusion is that increased precipitation, perhaps related to increased sea surface temperatures, is delivering more of the atmospheric dust into the oceans, increasing the dust-derived metal concentrations in the oceans while at the same time reducing the prevailing atmospheric aerosol concentrations.



Coastal climate and beach dynamics at Ponta do Ouro, Mozambique

Jury, M.R. (2015). *Scientific Research and Essays*, 10(1), 1-13, doi:10.5897/SRE2014.6061.

Many of us might consider a short holiday trip to a Mozambique beach known as the “tip of gold” (Ponta do Ouro) a good idea. However, if you’re Mark Jury, you would go there instead to investigate the impact of climate processes on the beach environment.

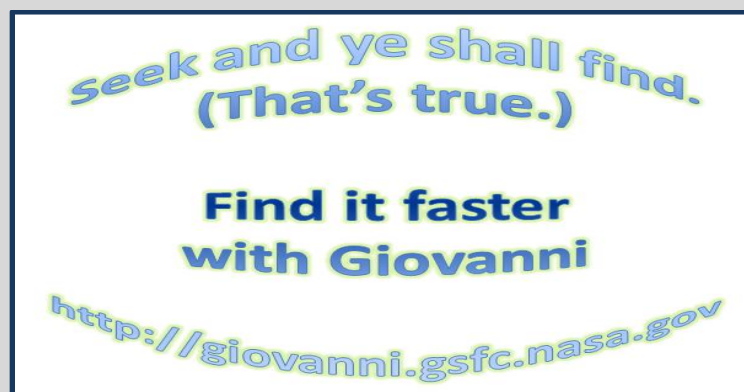
That’s what Jury did for a paper published in *Scientific Research and Essays*. Wave action and local currents are two of the primary influences on the variability of the beach at Ponta do Ouro. The local climate has experienced two distinct periods: a dry period from 2002-2007, followed by a transition to wetter conditions from 2010-2013. During the latter period, increased runoff from the land and a shift in the winds helped to rebuild the beaches. (Ponta do Ouro is a great place to study because a field survey of the beach is conducted every year.)

According to Jury, the upper portions of the beach have gotten flatter due to increased development and an associated increase in beachgoers. The lower beach, in contrast, has shown a recovery from erosion due to “a greater frequency of easterly waves and rainy weather”.

Jury used NASA data for suspended sediments, land temperature, and sea surface temperature in this research paper.



Ponta do Ouro beach, Mozambique. Image courtesy of the **Ponta do Ouro Accomodation** Web site.



Influence of air mass origin on aerosol properties at a remote Michigan forest site

VanReken, T.M., Mwaniki, G.R., Wallace, H.W., Pressley, S.N., Erickson, M.H., Jobson, B.T., and Lamb, B.K. (2015). *Atmospheric Environment*, **107**, 35-43, doi:10.1016/j.atmosenv.2015.02.027.

Have you ever looked up in the air and wondered where that particular piece of the atmosphere came from? Most of us are aware that the atmosphere is constantly in motion, which is evident especially when snow storms or fronts bring a rapid and noticeable change in the weather. Sometimes, wildfire smoke can be seen causing haze in the atmosphere hundreds of miles away from where the fires are actually burning, due to the transport of ash and smoke by the flow of the atmosphere above us.

The northern Great Lakes are a region characterized by lakes, rivers, forests, and relatively few people. For that reason, the properties of the atmosphere and what the atmosphere is carrying have not been studied as much as other, more populated regions. But the content of the atmosphere can have a significant effect on the forest environment, as it can transport components (such as acidic aerosols or trace metals on particles) that may influence the health and viability of the forest biota.

In 2009, during the Community Atmosphere-Biosphere Interactions Experiment (CABINEX), researchers at the University of Michigan Biological Station (UMBS) examined the atmospheric aerosols over their forest research station. UMBS is an area of about 10,000 acres near Douglas Lake, which is in the northern Lower Peninsula of Michigan, a few miles south of the Straits of Mackinac. The UMBS has three atmospheric research towers; the research was conducted on the Program for Research on Oxidants: PHotochemistry, Emissions, and Transport (PROPHET) tower.

For the majority of time during the study period, the prevailing winds brought air masses down to this area from the northwest, the general direction of Canada. Not surprisingly, these air masses were quite clean, in terms of aerosols and pollutants. The main aerosols were organics derived from trees and plants. However, during the less common situations when the air masses came from the east and south, which is where many of Michigan's cities and industrial centers are located (as well as those in northern Illinois, Indiana, and Ohio), both the particulate and sulfate aerosol concentrations increased significantly.

Ozone Measuring Instrument (OMI) nitrogen dioxide (NO_2) data from Giovanni were utilized to show the distinct difference in the NO_2 concentrations for the region adjacent to the UMBS, and for the industrialized region to the south.



PROPHET tower at UMBS

(photograph courtesy of Jared Lee)

Solubility of atmospheric nutrients over the eastern Mediterranean: comparison between pure-water and sea-water, implications regarding marine production

Kocak, M. (2015). *Turkish Journal of Fisheries and Aquatic Sciences*, **15**, 59-71, doi:10.4194/1303-2712-v15_1_07

As some of the previous summaries of research articles have shown, the atmosphere provides the land and the ocean with a variety of different substances: dust particles carrying metals, organic aerosols, acidic gases, rain, etc. These substances can (and often do) affect the environment to which they are transported and where they are deposited. The environment, be it marine or terrestrial, can be influenced by these substances.

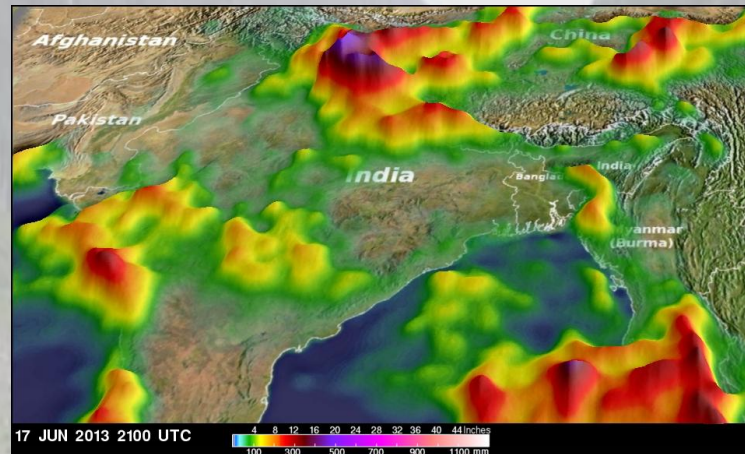
Mustafa Kocak investigated the different types of marine nutrients that can be transported by the atmosphere and provided to the oceanic environment – in this cases, the eastern Mediterranean Sea environment. Kocak measured the solubility of different chemical species that can provide the basic nutrients nitrate and phosphate. He used samples of filtered aerosols from Erdemli, Turkey, for this research.

He determined that aerosols from which phosphate can be derived have a distinct solubility difference between fresh and salt water, which is not the case for aerosols providing nitrate. Thus, the impact of the sources of phosphate on marine productivity was calculated to be considerably less than the impact of atmospheric nitrate sources. The amount of phosphate could support up to 80% of the marine productivity in autumn and winter, but the amount of nitrate was sufficient to support considerably higher marine productivity that was actually observed.

Kocak also examined the seasonal variability of the aerosol sources of the two nutrients. OMI aerosol index data was used to create air mass back trajectories to determine source regions.

The northeastern Mediterranean Sea, also called the *Cilician Basin*, can receive considerable dust deposition. MODIS image below from the NASA Earth Observatory, September 29, 2011.





Visualization of TRMM data showing the monsoon rains of June 17, 2013, that contributed to the Kedarnath lake outburst and debris flow disaster. Background: Image of Kedarnath after the disaster.

Lake outburst and debris flow disaster at Kedarnath, June 2013: hydrometeorological triggering and topographic predisposition

Allen, S.K., Rastner, P., Arora, M., Huggel, C., and Stoffel, M. (2015). *Landslides*, doi:10.1007/s10346-015-0584-3.

Every summer, the Indian subcontinent experiences the famous monsoon, which brings heavy flooding rains over much of the region. Topography and weather patterns can determine where the rain falls, and how fast and how much of it falls.

In mid-June 2013, the lower sections of the Himalayan Mountains in India received a very heavy amount of rain during the summer monsoon. This heavy rain caused flash floods and landslides and considerable destruction of property and structures. The most tragic event, which resulted in most of the 6,000 fatalities attributed to this episode of monsoonal weather, was the lake outburst and subsequent debris flow on June 16, 2013, that overwhelmed the village of Kedarnath. Simon Allen and his co-authors sought to investigate the factors that contributed to this disaster, and to determine if such factors can be used to evaluate the risk of lake outburst from other glacial lakes in this geologically active region.

The authors used Tropical Rainfall Measuring Mission (TRMM) data from Giovanni in conjunction with precipitation data from local sources as part of their evaluation of the hydrometeorological factors. They used daily precipitation rates from the 3B42 Version 7 data product. The TRMM data helped to provide a “longer term perspective” for the region. According to the authors, the TRMM data (starting in 1998) indicated that the amount of precipitation received for the several days prior to the disaster was “very unusual for this time of year”.

One insight provided by the TRMM data was that a significant rainfall event occurred on June 10-11, prior to the heavy rain occurring on June 16-17 when the lake outburst occurred. The heavy rainfall occurred almost simultaneously with unusually high stream levels due to elevated melting of snowpack and glacial ice. MODIS data for snow was also used in this study to establish a remarkably rapid decrease in snow-covered area in the month prior to the event. So the combination of warmer temperatures, increased snowmelt and runoff, and unusually heavy rains set up the conditions that led to the lake outburst and debris flow. The lake itself, Chorabari Lake, is at a low elevation in a valley with steep slopes, so that less rain could be absorbed by the land surface, and it received melt runoff from all of the higher elevation catchments and valleys. Chorabari Lake formed seasonally from glacial melt runoff in a depressed area adjacent to a glacial moraine, and crucially, had no outlet channel that would allow excess water in the lake to drain out safely.